benefits attributable to ground water protection activities. Many current uses are undocumented, complicating the task of estimating future levels with and without the protection program. Even where existing uses are well known, it is often difficult to forecast future uses, as they depend on trends and spatial patterns of economic development in relatively small areas. Where the absence of protection may result in human consumption of contaminated water, only indirect means exist for attributing dollar values to potential health effects. Assigning dollar values to health and ecological impacts or benefits is extremely difficult.

Risk and uncertainty, affecting both analyst and user, are considerations in all aspects of ground water valuation studies. Predictions of future ground water quality, of future ground water uses, and of the value of those uses are characterized by substantial uncertainty. Furthermore, ground water users are uncertain about present and future quality conditions and may actually forego some feasible uses because of perceptions of risk. Thus, uncertainty itself may result in lost benefits, and ground water protection programs that reduce uncertainty may restore those benefits even without changing ground water quality.

Costs of ground water protection programs consist of the value of the resources required to achieve the purposes of the program, including any opportunity costs imposed on those whose use of the resource is precluded or altered in the interest of protection. Unintended external benefits and costs may also result, and they are also a topic of economic analysis, to the extent that they can be anticipated.

Benefits and Costs

Ground water protection programs are presumably undertaken because they are expected to yield benefits at least equal to the costs. If this condition is met, then the total value of all scarce resources, including ground water, is increased as a consequence of the ground water protection program (the program produces positive net benefits). If the positive benefit/cost ratio is not met, then the total value of all resources is decreased by program implementation.

Benefit-cost analysis can also be an issue for individual program elements, as well as for overall protection programs. A specific proposal, such as a plan to regulate and inspect underground gasoline storage tanks, should be capable of providing incremental benefits at least equal to the additional cost of adding that element to an existing program. If this test cannot be met, it is apparent that the overall purpose of the program could be better served in some other way.

When testing program elements, it is important that incremental benefits

